AFIT/GTM/LAL/97S-5

PREDICTING MISHAP RATES AT CLOSING USAF MAINTENANCE DEPOTS

THESIS

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THESIS

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Abstract

It is clear that the Department of Defense and the USAF, in an effort to cut costs, will continue to reduce infrastructure through base closures. This has particular implications to the civilian employee who will likely lose his or her job. The purpose of this study was to review the most recent literature relating to safety and industrial facility closures and develop a theoretical model for predicting accident or mishap rates.

From the literature reviewed, a theoretical model is proposed containing five candidate variables intended for measure; perceived adequacy of employee safety training, perceived safety culture, perceived safety climate, self-reported employee morale, Safety Locus of Control; as well as five candidate indicator variables intended for measure; equipment maintenance levels, company resources allocated for safety, levels of overtime performed, quality or re-works, occurrence of personal site visits by Distinguished Visitors.

Potential survey instrument items are provided along with a proposed implementation plan for the five Air Logistic Centers. Prevention of accidents through proactive policies may lead to additional savings through claims cost avoidance. Model validation and item analysis are left as a follow-on effort to this research.

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I. Introduction

Conditions Which Prompted the Study

With the end of the Cold War, the drawdown in military personnel, declining military budgets, and the emphasis on responding to two major regional contingencies, DoD's logistics system must now support a smaller, highly mobile, high-technology force with more flexible and responsive processes at a lower total cost. In response, the 1996 edition of the DoD Logistics Strategic Plan included the need for a restructured logistics system and stated two desired outcomes of restructuring logistics: "better, faster, and more reliable, and highly mobile response capability and a leaner infrastructure that better balances public/private capabilities" (Logistics Strategic Plan, 1996:15).

In conjunction with a leaner infrastructure, the Base Realignment and Closure (BRAC) committee announced their decision to shutdown USAF depot maintenance functions at Kelly AFB (San Antonio ALC) and McClellan AFB (Sacramento ALC). The depot maintenance functions are designated to move to the three remaining USAF Air Logistic Centers (ALCs). Ground safety officials are concerned that industrial mishap rates will rise as a result of closure related stresses in the workforce (Farnell, 1996a). This hypothesis is supported by recent research. When a plant shuts down, worker's may perceive a drastic change in, or elimination of, their life chances. A

rational calculation of these life chances may result in anxiety, depression, and other forms of anguish (Hamilton et al, 1990).

Problem

Along with concerns for the health and welfare of the worker, increased mishap rates will drive compensation costs up. Increased compensation costs have the ability to offset potential savings to be recognized through depot closure. Work related accidents cost employers billions of dollars every year. Accidents affect the profitability of a company due to lost production time, disability payments, lowered morale, damaged equipment, wasted materials, and higher insurance costs (Huber, 1987).

Accidents and injuries occur during almost every activity that people participate in and in every place they live, work, and play. In 1990, about 25 percent of accidents occurred on the job or while commuting to and from work (RAND, 1991:7). The statistics on work related injuries are staggering. The National Safety Council (1997) estimated the 1996 death total for unintentional work injuries was 5,000. Disabling injuries numbered about 3.4 million. Work deaths and disabling injuries in 1996 resulted in about 70 million lost workdays. The total costs amounted to over $290 billion (National Safety Council, 1997).

In order to minimize costs associated with mishaps or accidents, safety officials must be able to identify current trends and act accordingly. We're unaware of any tools currently available that assist safety managers in predicting accident rates during a closure.

Data Description and Analysis

In the Department of Defense (DoD), there currently exists some confusion on the issue of increasing mishap rates. Recently, DoD sent a tasker to the USAF requesting information on their efforts to prevent mishaps given that "mishap rates increase at installations when they are placed on the BRAC list" (Farnell, 1996b). Current data obtained from HQ AFMC/SE (Figures 1 and 2) do not support the anticipated increase in mishap rates. One potential answer is that DoD is concerned with later time periods, closer to final closure, when mishap rates supposedly spike.

One problem encountered is in the area of availability of data. Prior to 1992, ground mishap rates were calculated using DODI 6055.7. These rates did not allow comparisons between military and civilian workers nor civilian industry. To overcome this shortcoming, USAF officials changed the methodology for calculating mishap rates. Current calculations are made where 200,000 is the base for 100 full-time equivalent workers (working 40 hours per week, 50 weeks per year) (Standard Industrial Classification Manual, 1987).

Any statistical analysis on available data is insufficient for the research problem at hand. Accident data bases serve a useful purpose in identifying trends in accident data. One limitation is that many accidents result from a complex chain of events that cannot be adequately described by existing classifications. Additionally, "relying on accident reports to determine unsafe situations is analogous to closing the barn door after the horses have left" (Sanders & McCormick, 1993:664). It can't be determined exactly

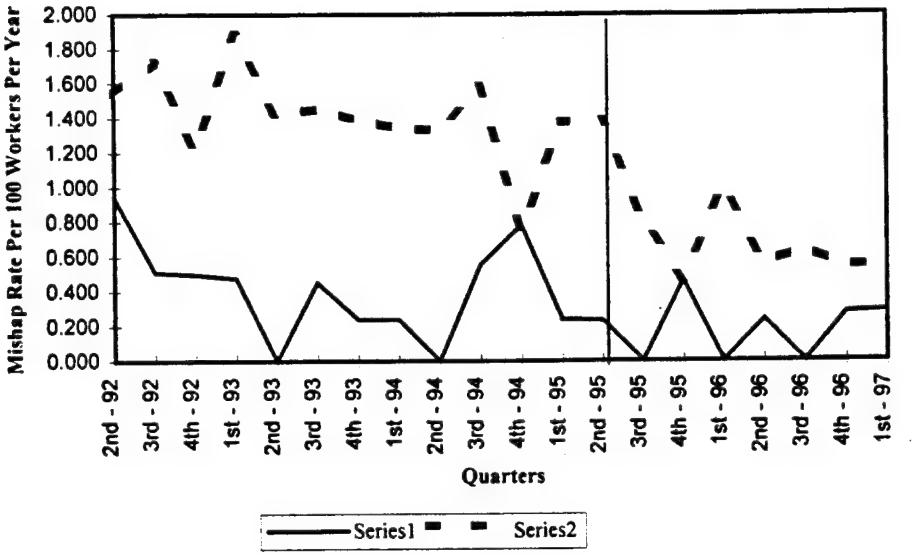

Figure 1: San Antonio ALC - Quarterly Mishap Rates
Note: Series 1 (Military), Series 2 (Civilian)

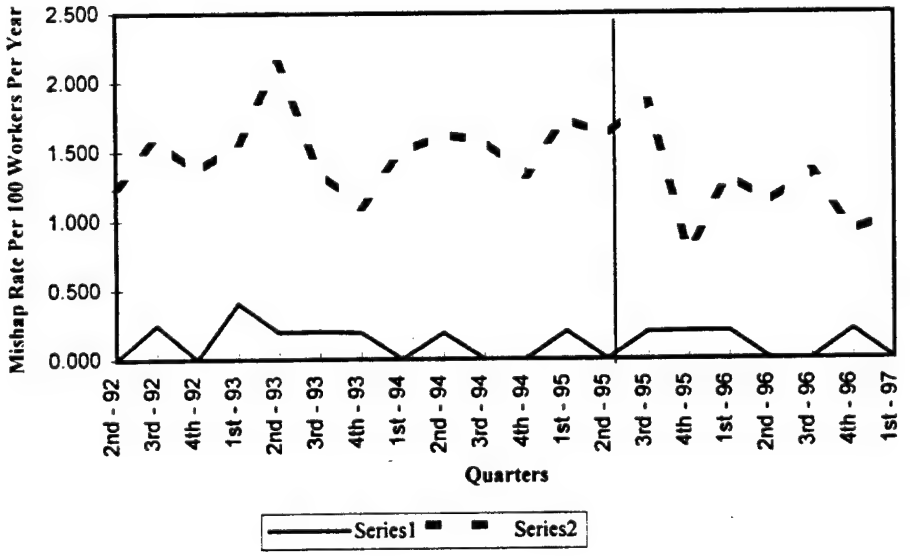

Figure 2: Sacramento ALC - Quarterly Mishap Rates
Note: Series 1 (Military), Series 2 (Civilian)

what causal relationships between base closure and mishap rates exist as actual closure will not take place until the year 2000. However, one must understand where we have been before determining where we are going.

The data made available to this author was from HQ AFMC/SE. In USAF organizations, procedures for determining mishap categories and instructions for reporting their occurrence are very detailed (AFI 91-204, 1996). Mishap rates were reported based on previously stated criterion. Monthly rates were gathered for the period of April 92 to March 97. For purposes of smoothing, monthly rates were combined to form quarterly rates. The result is 20 quarters of data on work-related mishap rates for both military and civilian employees. A cursory look at the data displayed in Figure 1 and Figure 2 leads one to believe that civilian employee rates declined after the June 95 BRAC announcement. Meanwhile, military rates have held more constant. One possible explanation is that military workers will not lose employment due to depot closure. Instead, military employees are more likely to be transferred to another base which is a constant part of the military experience.. On the other hand, civilian employees will either be forced to find other employment, or move to another part of the country to continue their government service. What is perplexing is that mishap rates for civilians apparently declined after the BRAC announcement. Is the decline in civilian rates merely a precursor to inevitable rises as actual closure draws nearer?

Purpose

The purpose of this research is to analyze current literature on the subject of mishap or accident rates. In addition to historically sound beliefs about accident causation, literature directed at potentially predicting accident rates is reviewed. From this research, a hypothetical regression model for predicting rates is proposed, as well as instruments for gathering relevant data and analysis.

This research is merely a first look into the area of mishap rates and their predictability during the closure of two military depots. Validation and application of the proposed model will remain a follow-on effort.

Research Questions

Is the closure of a military depot or industrial facility a potential cause of increased accident rates? What variables are most important in accurately and reliably predicting accident rates?

II. Background

Historically, the focus of occupational safety has taken place in stable environments which will remain operational for the immediate future. The Occupational Health and Safety Act of 1970 expressed the goal of assuring that all working men and women are able to work in a safe environment. The employers' responsibility is to supply a place of work that is free from recognized hazards which might result in serious physical harm, or death, of an employee (OSHA, 1993). The employer is therefore required to provide just such an environment even when going through the process of closing a facility. The basis of this research is derived from the level of commitment the USAF has towards providing a safe working environment for all employees.

After a lengthy review, no research in the direct area of correlating accident rates of workers involved in the process of plant or facility closure was found by the author. Similarly, a search of the DTIC database resulted in no apparent DoD studies of the anticipated causal relationship between base closures and mishap rates. Therefore, a literature review of the myriad of research devoted to worker safety follows in hopes of better understanding the causal relationships and predictability. The idea contained within is not to discuss all the research relating to worker safety, as that would require an encyclopedia size review, but rather to touch on the most recognized topics and expand on the predictive research.

> It is undoubtedly true that a detailed examination of each stone tells much about the structure of a mosaic, but the contribution of each to the value of the whole flows from the integration of the various parts, and can only be fully determined through an examination of the whole, and of the inter-relationships among the parts in the whole. (Arbous and Kerrich, 1953:146)

Traditional Research

Designing for Safety. Aside from behavior modification and persuasion, perhaps the best way to promote safety in the work place is through design. Some experts believe improving safety and reducing human errors and injuries should be the main criteria used by engineers and human factors advocates in designing equipment, facilities, and procedures. The most effective way to eliminate job hazards is through proper design (Sanders and McCormick, 1993:692). Numerous professionals already promote, and some demand, safe work center and work station designs to minimize the potential for human error. Kumar (1994) conceptualized a model for fatigue-mediated overexertion, margin of safety, and job-related risk of injury. He states that "all musculoskeletal injuries have a bio-mechanical basis, which is affected by three variables; force magnitude, effective exposure, and the extent of range of motion in these activities" (Kumar, 1994:204). The three factors will work together to produce tissue failure due to fatigue. If one were to analyze specific jobs to determine force, exposure and motion characteristics, the margin of safety or "job mediated risk" could be derived using a complex mathematical model. An inherent problem is that the model has not yet been validated within any single comprehensive study. In the context of this research, it is unlikely that any significantly new procedures or equipment will be introduced to the workplace.

Not only is the design of equipment, facilities, and procedures important, the designs of work schedules and worker limitations are also important. Over time, and the ability of an individual to work safely is typically an individual attribute. People differ in

their abilities to function safely during and beyond the normal work day (Schuster, 1985). However, the effects of fatigue due to excessive overtime are not limited to the front line laborer. Managers can also be affected and may make potentially dangerous decisions that place others in danger. The willingness of employees to work excessive hours is admirable, but should not be acceptable when it jeopardizes job performance (Covault, 1986). Research on shiftwork falls into two broad categories: the effects of shiftwork on organizational goals, such as efficiency, productivity, safety issues and absenteeism, and the effects on the individual, social issues, health and well being, and general attitudes toward their job (Alluisa 1982:176). Limitations on overtime, especially excessive amounts, should be designed and incorporated into an organizational culture.

Training. Many practitioners focus on training as the primary way to minimize or eliminate unsafe acts. If a person is introduced to the potential performance related risks and educated on how to avoid those risks, the likelihood of human error is reduced. Just as training is directed toward eliminating human errors, the human is the major limitation to training. People do not always perform in manners similar to their training. People may be rushed, or forgetful, and revert to old habits they possessed before training took place. Another limitation is money. Training can be very expensive, and in many situations training should be viewed as a continuous process which requires constant investment of time, energy, and money (Sanders & McCormick, 1993:660). Similarly, the exact requirements necessary for a person to perform a task or set of tasks is difficult to determine. Even if the tasks can be determined, testing procedures are often difficult to administer.

Selection. The personnel selection approach allows employers to screen applicants for positions where job related injuries are likely if proper safety rules and procedures are not followed. High accident risk applicants can be identified and thereby screened out (Jones & Wuebker, 1988). If workers could be selected for jobs that specifically match their mental and physical characteristics, it is hypothesized that the potential for accidents could be minimized.

Perhaps the oldest studied criterion for employment selection deals with accident proneness. Early researchers, through observation, defined a personal trait which caused some people to have more accidents than others in work conditions where the risk of accident was equal for all (Arbous & Kerrich, 1953). This implied that it is possible to either differentiate between two types of people; those who are accident prone and those who are not (or it should be possible to rank order people on their level of accident proneness).

The studies that validated the theory of accident proneness were typically statistical, not clinical in nature. Such statistical studies and their significance is extremely questionable in arriving at the causes of accidents (Arbous & Kerrich, 1953). Not all members in a given population of workers are equally exposed to job and environmental hazards. Sanders and McCormick believe that for the theory of accident proneness to be true, accident proneness would be a permanent characteristic of the individual. More recent studies have all but eliminated the notion of accident proneness as an efficient means of predicting or eliminating accidents.. A more realistic view is developed in accident-liability theory. This theorizes that people are more or less prone

to accidents in specific situations and the condition is not likely permanent (Sanders & McCormick, 1993:665).

A more promising approach to corporate safety is accident reduction through a more sophisticated approach to personnel selection. Jones and Wuebker (1988) reviewed several studies that used the Personnel Selection Inventory-Form 3S (PSI-3S) battery, developed by London House, Inc., for screening applicants. The results found are that industrial accident rates can in fact conceivably be reduced. The PSI-3S has four subscales (see Appendix A); Honesty, Non-violence, Drug-avoidance, and Safety Locus of Control subscales. Individual research efforts found that Honesty correlates with safety attitudes (Wuebker, 1987). In another study that was conducted by Moretti, presented at the 1983 meeting of the Society of Police and Criminal Psychology, and reported by Jones and Wuebker (1988:188), found that Non-violence assesses tendencies to engage in violent or emotionally unstable behavior and is reasonably expected to correlate with accident or injury rates. On-the-job alcohol and drug use has been linked to the occurrence of industrial accidents (Jones, 1980). The Safety Locus of Control Scale, originally designed as a paper and pencil inventory, was designed to better understand the personality traits that contribute to accidents (Jones, 1984). The scale is based on a personality construct called locus of control (LOC), which reflects the degree to which an individual perceives that the consequences of behavior and life events are in his or her control. A person with an internal LOC believe that their behavior has a direct relationship to consequences. Someone with an external LOC perceives no cause-and-effect relationship between their actions and outcome. During a drawdown or closure process, it is doubtful that any significant or large scale employment opportunities will

become available. Nevertheless, incorporation of a sound pre-employment test-battery would potentially reduce the incidents of accidents of new employees.

Culture. The safety culture of an organization is complex and hard to study. However, "the concept that the organization's beliefs and attitudes, manifested in actions, policies, and procedures, affect its performance is not new" (Ostrom et al, 1993:163). Safety culture may be influenced by many factors such as the marketplace, regulatory setting, or the vision, values, and beliefs of its leaders. Ostrom and others studied the concept of safety culture and how areas needing improvement can be identified. They found that a good safety culture may be represented by employees with particular patterns of attitudes toward safety practice. Good cultures also gather safety related information, measure performance, and educate people to work more safely. They not only solve immediate problems but also identify and address situations before they become a problem. Ostrom and others (1993:170) developed a survey, EG&G Idaho safety norm survey, for the Department of Energy (DOE). The survey was used to assess the safety culture at the Idaho National Engineering Laboratory (INEL). Through statistical testing the survey was found to have good internal consistency and recommended for use outside the DOE. As this was the first documented survey instrument of its type, the authors include it in their report (see Appendix B). The key is for the organization to assess the data themselves and decide what areas need improvement as well as how to achieve its individual goals.

Climate. Perceived work climate has been shown to guide appropriate, as well as inappropriate employee behavior. It can be hypothesized then that "safety climate" will guide appropriate or inappropriate work actions. Zohar (1980), Brown and Holmes

(1986), Dedobbeleer and Beland (1991) were concerned with measuring safety climate, or set of perceptions, and the relationship with employee performance of production workers. Climate can be defined as "a set of perceptions or beliefs held by an individual and/or group about a particular entity" (Brown and Holmes, 1986:455). Based on cues present in their work environment, employees are believed to develop perceptions and expectations of appropriate behavior (Zohar, 1980:100).

Zohar (1980) constructed a model for assessing employee perceived safety climate and tested it on a group of Israeli production workers. His model included eight different climate factors: importance of safety training programs; management attitudes toward safety; effects of safe conduct on promotion; level of risk at workplace; effects of required work pace on safety; status of safety officer; effects of safe conduct on social status; and status of safety committee. His idea was to establish a safety climate score and relate this score to employee performance in hopes of finding a strong relationship between climate scores and actual safety performance.

Brown and Holmes (1986) validated Zohar's model on a sample of American production workers. Using an exploratory factor analytic approach they reduced it from an eight factor model to a three factor model. The three climate factors were: employee perception of how concerned management is with their well being; employee perception of how active management is in responding to this concern; and employee physical risk perception.

In turn, Dedobbeleer and Beland (1991) tested the Brown and Holmes model using a sample of American construction workers. Their results provided some support, but via use of the LISREL weighted least squares procedure, they found that a two factor

safety climate model provided an overall better fit. The two factors are: management's commitment to safety in terms of management's safety attitudes and practices; and workers involvement in safety. Construction workers perceive safety as a joint responsibility between individuals and management. The proposed model may be useful in the design of safety climate surveys. Additionally, they argue safety policies should address both management's and workers' safety concerns. Furthermore, they maintain that management's concerns and actions should be highly publicized and workers should be involved in the development of safety programs, safety audits, and problem solutions (1991:102).

Morale. Morale is a job attitudinal factor much the same as job satisfaction. Pestonjee and others (1977:79) describe employees morale as "a general attitude of workers based upon their faith in the fairness of employer's policies and behavior, adequacy of immediate leadership, a sense of participation in the organization and an overall belief that the organization is worth working for." In a study of locomotive manufacturing workers in India, Pestonjee and others (1977:80-84) tested the hypothesis that a negative relationship exists between morale of workers and their involvement in accidents. To test the hypothesis, the Employees' Morale Scale (EMS) was used. The EMS includes four sub-scales: fairness of employer's policies and behavior; adequacy of immediate leadership; sense of participation; and sense of worth of the organization. The results of the study support the hypothesis of a negative relationship between morale of workers and their involvement in accidents. Specifically, they found a statistically significant difference ($p < .01$) between the EMS scores of groups classified as members of either an accident (AG) group or non-accident group (NAG). Comparison of the

scores of the two groups clearly show that scores in the NAG are higher in comparison to AG scores.

Predictive Research

Actively Caring Model. Instead of relying solely on the members of the safety office and management to promote safety in the workplace, employees should participate in helping their peers. Geller (1991) addressed the need to get employees involved in implementing behavior changing processes with the introduction of the actively caring (AC) model. AC was operationally defined as "employees acting to benefit the safety of other employees (e.g. observing and recording the safe and unsafe behaviors of coworkers, and then giving them constructive behavioral feedback)" (Geller et al, 1996:2). Individuals found to score higher in AC were more willing to go above and beyond routine duty and provide feedback to coworkers about their safe and unsafe behaviors. It was hypothesized that more extroverted individuals will score higher on measures of AC than would more introverted. A direct relationship was found to exist between extroversion and propensity to actively care for occupational safety (Geller et al, 1996:3-6).

Employee involvement is a key issue in addressing the human element of occupational safety. The original intent of the AC model was to identify those employees most likely to become intervention agents for organizational behavior change and guide the development of intervention strategies for increasing the probability that employees will become intervention agents (Geller, 1991). Therefore, if certain personality traits exist causing individuals to more actively care or get involved in an extra safety effort,

then it would be worth while to implement techniques to increase these traits. Three person factors "did predict employees' willingness to go beyond the call of duty"; extroversion, personal control, and group cohesion (Geller et al., 1996:7). More research needs to be done to determine whether these characteristics can be taught in workplace training sessions.

Person-Environment Fit Theory. The interaction between the person and the work environment that contributes to performance related behaviors is person-environment (P-E) fit theory (French et al., 1982). P-E fit theory would suggest that individuals who have a poor fit with their current environment may be more likely to experience stress and be related to the occurrence of accidents. Sherry (1991) sought to determine whether there were significant differences in the degree of fit between people who reported accidents or injuries. Sherry also attempted to answer a second question of whether employee attitudes towards their work environment are predictive of accidents and injuries.

Using a self-developed survey containing 19 subscales, Sherry (1991:412-414) tested the P-E fit theory on a large group of rail transportation workers in two studies. In the first study, significant differences were found between those who had and had not had an injury in the previous 12 months on the following P-E fit scales; Supervisor Support, Credibility, Recognition, and Peer Safety Practices. These results tentatively support the idea that a poor P-E fit is an important construct in determining the occurrence of accidents and injury reports among railroad transportation workers.

In the second study, Sherry (1991:414-415) performed discriminant analysis of the data derived from the research instrument. The analysis was run post-hoc to

determine whether the scores on the instrument are able to predict the occurrence of an accident either before or after the initial study. The analysis was able to correctly classify 68.8% of the post-survey injury group and 95.5% of the pre-survey injury group. The data suggests that there may be a relationship between the attitudes an individual has toward their work environment and supervisor and the occurrence of accidents and injuries.

OSHA Program Assessments. The Occupational Safety and Health Administration (OSHA) has long been known as an enforcement agency. A formerly little used OSHA program of consultation has recently received more publicity. Formerly, the consultative services were not offered at the federal level due to a lack of legislation. Today, there is an active state operated consultative program in each of the 50 states along with similar programs in the District of Columbia, Guam, Puerto Rico, and the Virgin Islands (Weems, 1993). The consultative service provided at the state level was designed to encourage voluntary compliance among small employers without fear of immediate retribution, and detailed guidance is provided in the consultation manual (OSHA, 1987).

Weems (1993) studied the effectiveness of OSHA's safety program assessment method in predicting workplace safety performance in the state of Alabama. The OSHA system for evaluating safety programs involves 22 indicators which are rated by state consultants following a comprehensive safety survey of each evaluated company and had never been evaluated. Weems used Poisson multiple regression techniques to evaluate the influence of the 22 indicators in predicting lost-workday cases (LWC). Through several iterations of step-wise fitting procedures, a significant portion of the variance in

LWC (R-square = .44) were most effectively predicted by a set of nine predictors found in Table 1.

Safety Locus of Control The Safety Locus of Control Scale was designed to better understand the personality traits that contribute to accidents (Jones, 1984). The scale is based on a personality construct called locus of control (LOC), which reflects the degree to which an individual perceives that the consequences of behavior and life events

Table 1. Nine significant OSHA predictor variables.

IND15 - a measure of equipment maintenance levels
NLWCR - s surrogate measure for type of industry
IND7 - a measure of hazard assessment by outside experts
IND3 - a measure of supervisory safety responsibilities
IND5 - a measure of safety communication
IND6 - a measure of how well management sets an example for safe behaviors
IND4 - a measure of company resources allocated for safety
IND17 - a measure of emergency planning and procedures
IND8 - a measure of the adequacy of periodic safety self-inspections

Note: Listed in decreasing order of influence.

are in his or her control. Individuals with internal safety LOC (i.e., high safety consciousness) expect a relationship between their actions and any accidents they may or may not have. Individuals with external safety LOC (i.e., low safety consciousness) tend

to perceive that accidents and injuries are determined by forces outside their control, such as bad luck or poor management practices (Jones and Wuebker, 1993:450).

An initial validation study was conducted with college students who were placed in one of five categories based on number of accidents they had in the past six months. The results were that the mean safety score of the high accident risk group was found to be statistically significantly more externally oriented ($p < .05$) than the low accident risk group (Jones and Wuebker, 1985).

A similar study was conducted by Jones and Wuebker and reported by Wuebker (1986). Hotel employees completed the Safety Locus of Control Scale and a self-report survey of accidents incurred in the previous year. The employees were placed in one of three groups based on their safety scale scores; low safety conscious group (external), medium safety conscious group (intermediate), high safety conscious group (internal). The results showed that the average number of reported industrial accidents per year was significantly higher for the low safety conscious group as compared to the medium safety conscious group and the high safety conscious group ($p < .05$). Additionally, it was found that a significantly higher percentage of the low safety conscious group were involved in one or more major accidents at work, compared to the medium and high groups ($p < .04$).

Subsequently, Wuebker (1986) performed a study of safety training and its effect on safety LOC. Professionals with varying degrees of safety training and knowledge completed the Safety Locus of Control Scale. The professionals who had a greater level of training and experience in the safety profession were significantly more internal in their safety control beliefs than the rest of the population ($p < .05$). These results suggest

that higher levels or amounts of safety training may be associated with increased internality in safety locus of control beliefs.

The safety scale can possibly be used as part of a comprehensive personnel selection battery designed to screen employment applicants for safety-sensitive positions. Additionally, the safety scale can possibly be used to assess the need for special or increased safety training. Additional research is needed to determine if these findings generalize to other samples, other employment settings, and other accident criteria (Jones & Wuebker, 1993). Increased understanding of the human factors in accident causation could facilitate the development and implementation of effective programs designed to prevent industrial accidents and injuries.

III. Method

No longer can accidents and occurrences of unsafe behaviors be limited to individual-level factors. Recent research of industrial accidents has given increased attention to the role of organizational factors and their role in the accident sequence.

Model

Though this research design is exploratory, it is based on previous research cited within, as well as informed speculation of situational factors possibly present in a drawdown or closure of a military facility. I am suggesting that the variables of the model will likely correlate and not find causality of accident rates. In simple form, the theoretical model is:

$$A_R = b_0 + b_1T_{ES} + b_2C_S + b_3CL_S + b_4M_E + b_5S_{LOC} + b_6IND_1 + b_7IND_2 + b_8IND_3 + b_9IND_4 + b_{10}IND_5 + e$$

where:

A_R = Accident Rates

b_0 = Intercept

T_{ES} = Measure of adequacy of employee safety training

C_S = Measure of perceived safety culture

CL_S = Measure of perceived safety climate

M_E = Measure of self-reported employee morale

S_{LOC} = Measure of Safety LOC

IND_1 = Measure of equipment maintenance levels

IND_2 = Measure of company resources allocated for safety

IND_3 = Measure of levels of overtime performed

IND_4 = Measure of quality or re-works

IND_5 = Measure of occurrence of personal site visits by Distinguished Visitors

e = Error or Disturbance

This proposed model is not expected to predict the rates of occurrence of accidents with great accuracy. Nor does the model imply that each independent variable is separate and exclusive of the others without interaction. The model is simply a starting point from which we might gain a better understanding of the effects of a facility closure on accident rates.

Data Origination

The following discussion is a description of why the independent variables were chosen, along with a proposed method or instrument with which data for actual analysis may be gathered. Where a survey instrument may be appropriate, I offer some potential survey items that will require further refinement before implementation.

Candidate Variables.

A_R = *Accident Rates.* As reported according to the Standard Industrial Classification Manual, 1987.

T_{ES} = *Measure of perceived adequacy of employee safety training.* Perceived

training is perhaps more important than actual training accomplished. Training should be considered a continuum which requires constant attention in changing environments such as a facility closure.

Proposed Survey Items (Employees and Supervisors):

1. The safety training I receive permits me to work free of accidents or injuries.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

2. Typically, safety training occurs only after a mishap.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

3. If it wasn't required, safety training would not be well-attended.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

4. Our safety training program is a waste of time.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

5. In this company, safety training is compromised in favor of more pressing demands.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

C_S = *Measure of perceived safety culture.* Good safety cultures likely have employees with particular attitudes toward safety. Norms within the organization often serve as guides of appropriate behavior. In a good safety culture employees might; be alert for unexpected changes, ask for help when necessary, be rewarded for calling attention to safety problems, be willing to approach other employees performing unsafe behavior.

Proposed Survey Items (Employees) (Geller et al., 1996):

1. If I know a coworker is going to do a hazardous job, I am willing to remind him/her of the hazards.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

2. I feel comfortable praising my coworkers for working safely.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

3. I am willing to warn other coworkers about working unsafely.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

4. I am willing to do whatever I can to improve safety, even confronting other coworkers about their unsafe acts.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

5. I am willing to observe the work practices of a coworker and record his/her safe and unsafe behaviors.

1	2	3	4	5	6
Always	Frequently	Often	Sometimes	Seldom	Never

6. I am willing to pick up after another employee to maintain good housekeeping.

1	2	3	4	5	6
Always	Frequently	Often	Sometimes	Seldom	Never

7. When I see a potential safety hazard, I am willing to correct it myself if possible.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

8. I am willing to pick up workplace litter I did not cause myself.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

Proposed Survey Items (Supervisors):

1. If I know a subordinate is going to do a hazardous job, I am willing to remind him/her of the hazards.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

2. It is important that I praise my subordinates for working safely.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

3. I am willing to pick up after employees to maintain good housekeeping.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

4. I am comfortable praising my subordinates for working safely.

1	2	3	4	5	6
Always	Frequently	Often	Sometimes	Seldom	Never

CL_S = *Measure of perceived safety climate.* Two main factors are believed to form a safety climate: management's commitment to safety in terms of management's safety attitudes and practices; and workers involvement in safety (Dedobbeleer & Beland, 1991).

Proposed Survey Items (Employees) (expanded from Brown & Holmes, 1986):

1. Workers' safety practices are important to management in this company.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

2. Supervisors and other top management truly care about my safety.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

3. My immediate supervisor makes us aware of dangerous work practices and conditions.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

4. My supervisor praises employees for safe conduct.

1	2	3	4	5	6
Always	Frequently	Often	Sometimes	Seldom	Never

5. Job safety meetings are held often enough.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

6. Proper equipment is always available in my workplace.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

7. It is very likely that I will be injured on the job in the next year.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

Proposed Survey Items (Supervisors):

1. Workers' safety practices are important to me.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

2. Top management truly cares about my subordinates safety.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

3. It is my job to praise employees for safe conduct.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

4. Job safety meetings are held often enough.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

5. Proper equipment is available to my subordinates.

1	2	3	4	5	6
Always	Frequently	Often	Sometimes	Seldom	Never

6. I expect one of my subordinates to be injured on the job in the next year.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

M_E = *Measure of self-reported employee morale*. Accident prevention programs should convey a feeling that employers are fair-minded, supervisors and management are effective and efficient, and employees play a part in setting organizational goals and objectives (Pestonjee et al., 1977).

Proposed Survey Items (Employees):

1. All employees are treated equally.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

2. Policies and procedures are implemented similarly for the entire organization.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

3. Supervisors and other managers promote success in the workplace.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

4. If employees were left to perform on their own, the organization would be more productive.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

5. I personally have a say in what the organizational goals are.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

6. Management sets objectives that I have no control over.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

Proposed Survey Items (Supervisors):

1. I personally have a say in what the organizational goals are.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

2. I have no control over the objectives set for my section or area.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

3. If I were left alone, I could make my area or section more productive,

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

4. My area or section is treated differently than the rest of the organization.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

S_{LOC} = *Measure of Safety Locus of Control*. Organizations with individuals possessing an Internal Safety LOC have been found to have fewer and less severe accidents. Additionally, an Internal Safety LOC can be developed through education and training (Wuebker, 1986).

Proposed Survey Items (Employees and Supervisors)(expanded on Janicak, 1994):

1. In the long run, the accidents that happen to us are due to chance.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

2. Most accidents are the result of unsafe actions, unsafe conditions or both.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

3. Capable people who fail to prevent accidents have not taken proper precautions.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

4. Safety requirements tend to be so unrelated to the job that following them is useless.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

5. Most people don't appreciate the extent to which work injuries are controlled by accidental happenings.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

6. With enough effort, I can prevent work-related injuries.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

7. One major reason why we have accidents is because people don't take enough interest in safety.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

8. It is difficult to have much control over the things that cause accidents.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

9. Accidents will always occur, no matter how hard people try to prevent them.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

10. Accident prevention is the responsibility of supervisors and others; there is not much the "little guy" can do about it.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

Candidate Indicators.

IND_1 = *Measure of equipment maintenance levels.* As a facility continue through the process of closing, it is likely that attention to detail and maintenance of equipment may decrease due to work pace or distractions. A measure for this indicator should concern all equipment in the workplace. Ratings may be heavily influenced by perceived levels of orderliness, cleanliness, and general housekeeping (Weems, 1993).

IND_2 = *Measure of company resources allocated for safety.* Staff resources, training budgets, equipment purchases, facilities and funding for safety promotional campaigns should be considered in this measure (Weems, 1993). As facility closure becomes more immediate, management may be unwilling or incapable of allocating the same level of resources to safety.

IND_3 = *Measure of levels of overtime performed.* We sometimes see a change in the pace of work may be necessary to meet all facility closure time lines. It is likely that there will be an increase in the occurrence and amount of overtime work performed.

IND_4 = *Measure of quality or re-works.* Similar to overtime, imminent closure may produce a feeling of apathy in the workplace. The quality of the work performed may relate directly to following proper policies and procedures for task performance. These policies and procedures are likely designed so that employees may work in a safe manner.

IND_5 = *Measure of occurrence of personal site visits by Distinguished Visitors.* Once a facility closure is announced increased leadership attention to the facility is imminent. The attention at a military facility runs the spectrum from high ranking military officials responsible for the facility and its functions in some way, to other ranking officials that just want to see the facility before it closes. Additionally, there is an increase in the number of visitations from the civilian sector. These range from local government officials seeking a reversal of the decision to close the facility in their district, to those that have ulterior motives, such as prominent businessmen who would likely want control of the facility for profit motives. The effect of increased attention is likely an increase in (and constant attention toward) housekeeping details.

Final Instrument Construction

The following is a proposed plan for collecting the aforementioned data. The individual survey items should be compiled into one survey with individual sub-scale items spread randomly throughout the survey. Responses to the items should be recorded according to a 6 point Likert scale, thereby forcing employees (even if only slightly) to have an opinion for each item. The anchors, as previously shown, will need to be changed or reversed to avoid the opportunity for respondents to anchor on a particular

answer. Demographic information should be included on the questionnaire to include age, educational background, and seniority. It will likely be necessary to refine the sub-scale items and test them for validity. After this is accomplished, the survey can be administered. A companion instrument should be constructed for supervisors with the same sub-scales but written from the supervisors' perspective as previously illustrated.

Some items might be identical or very similar. Change would be very likely in scales measuring Safety Culture, Safety Climate, and Employee Morale. Consider the following item pairs:

Safety Culture

Employee: I feel comfortable praising my coworkers for working safely.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

Supervisor: It is important that I praise my subordinates for working safely.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

Safety Climate

Employee: It is very likely that I will be injured on the job in the next year.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

Supervisor: I expect at least one of my subordinates to be injured on the job in the next year.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

Employee Morale

Employee: All employees are treated equally.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

Supervisor: My area or section is treated differently than the rest of the organization.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

Revisions of our proposed model should be considered. Specifically, assessing the degree to which employee/supervision differences explain variance in mishap rates.

IV. Data Collection - Implementation Plans

In order to better understand the intricacies and nuances inherent at a military depot, and avoid any bias from current leadership, a telephone interview was conducted with Lt Col D. K. Smith. Lt Col Smith formerly served as the Assistant Engine Division Production Chief at San Antonio ALC. He explained that there often exists an adversarial relationship between management and the labor union at USAF depots. To produce the most usable data, any survey or data collection instrument must be conducted during duty hours (it is extremely unlikely that any employees would participate on their own time). Additionally, participation in the survey must be mandated by at least the ALC Commander level. Therefore, it should not be difficult to achieve any level of participation required. Employees in every department, to include the office and clerical staff, should be included (Smith, 1997).

It should be introduced as an information gathering tool intended to find both good and bad aspects of safety, and implemented as close to the beginning of the work day as possible. No names should be included on the survey and it should be explained to employees that their answers will be completely anonymous. However, codes should be used to categorize the surveys according to department or work group.

Individual measures of the indicator variables will need to be developed. It is important to include all levels of the work force in development of the measures. Additionally, a score for each indicator variable will need to be assigned from a rating scale (1 to 6). Individual analysis of scales can then be done to determine individual scales which were significant predictors (i.e., discriminators). At the organizational level

(i.e., ALC-level), a Chow analysis (Chow, 1960) of the entire model should be conducted comparing closing to non-closing ALCs. The Chow procedure is described thoroughly in Johnston (1972:199-207) and applied between organizations in Gomez-Mejia et al (1987).

Since the analysis of our data will require item analysis and factor analysis to verify that item scales are performing as intended, we need large data sets. Analysis will be difficult to accomplish with fewer than 300 respondents. We would prefer to have at least 300 respondents per workforce category; employees at closing depots, employees at surviving depots, supervisors at closing depots, and supervisors at surviving depots. Desires may be ambitious and follow-on effort is likely to have to settle for smaller data sets. However implemented, goals should be the driving force in the implementation plans.

We can probably afford to assume that factor structure analysis and item total correlations are similar among employees at both locations, as well as among supervisors at both locations (and we may have no choice but to accept such an assumption based on response rates). Distinctions between employees and supervisors in work groups with high and low accident rates are more critical than individual analysis. Since many of our measures hopefully serve as indices of organizational climate, and this climate is at least a shop-level phenomenon, group scores may be more predictive of variance in accident rates among work groups or sections.

V. Conclusion and Recommendations

As the DoD moves into the 21st Century, it is apparent that force and facility reductions will continue in an effort to trim costs. In an effort to save money, it must not be forgotten that people need to remain the primary focus of management. All levels of supervision must make a concerted effort to keep the safety and well being of their personnel a primary concern.

This research effort is an initial study of the factors that may affect accident and injury rates during the closure process of an industrial military facility. The literature review and model proposed within are an attempt to describe the complexity of the situation. Safety and accident rates at the organizational level need to be viewed as an aggregate whole, not merely the individual parts.

When reviewing this research, it is important to do so in the context of the research questions asked. First, is the closure of a military depot or industrial facility a potential cause of increased accident rates? The answer is undoubtedly yes. Conversely, the closure process may in fact be the potential cause of decreased rates. The initial data of mishap rates when viewed across time suggest that mishap rates will go down after the closing of a facility is announced. It is theorized that as the actual closing date approaches, mishap rates will increase. Insight to add to these speculations may be contained in the tested model.

When facility closure is announced there is a marked increase in the attention given to the facility. Positive affects of the independent variables and indicator measures may be realized, thereby decreasing the incidence of accidents. Relatedly, as the final

closure date of the facility nears, managerial and employee focus may well shift resulting in negative affects of the independent variables and indicator measures. These negative affects may manifest themselves in an increased rate of accidents and injuries.

Due to this conclusion, I recommend that the proposed alternative or similar forms of gathering data be devised and implemented periodically, perhaps as often as every six months or less. Only through constant surveillance can potentially hazardous situations or environments be detected and countermeasures enacted.

The second research question can only be hypothetically answered at this time. What variables are most important in accurately and reliably predicting accident rates? The answer is a simple one; currently we don't know. Through a comprehensive literature review and personal experiences gained through participation in the closure of a remote military site, a model containing the most likely predictor variables has been developed. Experience of researchers and practitioners may well lead to omissions or additions to the model. Especially here, the old adage rings true: You have to learn to walk before you learn to run.

My recommendation is that someone take advantage of the opportunity at hand to study the affects of a plant closure on safety rates at the two closing depots and comparisons to control populations. No matter how preliminary or naive an instrument or measurement used, if knowledge can be gained in reference to the ability to protect life and limb, the effort will likely be worthwhile. If nothing else, perhaps this research effort will at least increase the attention given to hazards or potential safety deficiencies.

More than just discovering and understanding what factors most directly relate to mishap rates at closing depots, the implications of this research are much more important

to the safety community. If the cause of variance of mishap rates in groups or work areas can be determined, appropriate measures can then be implemented and the success of those measures analyzed. Furthermore, if the model proves valuable, refinements and alterations can be made to fit other circumstances in other settings.

Appendix A. Description and Reliability of PSI-3S Subscales

Scales	Descriptions
Honesty	Measures job applicants' attitudes toward theft and crime. People who score lower on this scale generally exhibit more rumination over theft activities, more projection of theft in others, greater rationalization of theft, less punitive attitudes toward thieves, and more inter-thief loyalty. Split-half reliability = .95. Examples of Honesty scale correlates include:theft apprehensions; admissions (self-report and polygraph exams); dollar value of thefts of cash, merchandise, and property; number of criminal acts committed; number of minutes of unauthorized work break extensions; convicted felon vs. job applicant status; prior criminal arrests; supervisor ratings for counterproductivity; cash drawer shortages; company shrinkage; termination for theft; dysfunctional turnover; number of disciplinary actions for company cash mishandling; and disregard for company rules in general.
Non-violence	Measures work applicants' tendencies toward on-the-job violent behavior and other related forms of counterproductivity, such as physical assault, vandalism of company property and merchandise, damage and waste of company materials, and argumentativeness. Split-half reliability = .87. Examples of Non-violence scale correlates include: number of violent acts committed; dollar amount of damaged company property and merchandise; physical assault of co-workers, supervisors, and/or customers; on-the-job waste of company materials and supplies; violence admissions (polygraph exams and self-reports); and poor customer service.
Drug-avoidance	Measures job applicants' tendencies toward illicit drug abuse in the workplace. Assesses risk of drug-related industrial accidents. Split-half reliability = .90. Examples of Drug-avoidance scale correlates include: weekly alcohol consumption rate; number of times intoxicated; coming to work hungover or intoxicated; number of on-the-job drug/alcohol use; self-reported on-the-job alcohol abuse; and selling illegal drugs; industrial accidents; and unacceptable urinalysis results.
Safety-control	Measures a set of attitudes endorsed by applicants with a history of serious and costly accidents and injuries. Assesses if applicants feel responsible for and committed to accident prevention. Split-half reliability = .85. Examples of Safety Scale correlates include: Injuries (minor, major); termination due to unsafe behaviors; level of safety education; unsafe workplace; medical costs of workplace accidents; supervisors' ratings of safe job performance; and driving safety.

Note: This table was taken from the study done by Jones and Wuebker (1988:189).

Appendix B. EG&G Idaho Safety Norm Survey

Safety Awareness

1. In our company, the employees are aware of their part in safety.
2. In our company, people think safety concerns do not relate to office workers.
3. People are well aware of the safety hazards in their area and are careful to minimize and avoid them.
4. Around here, people don't think much about safety.

Teamwork

5. Safety professionals in this company tend to be bright and capable people.
6. In this company, people ask for help with safety when they need it.
7. Around here, you'll be better off if you hide your problems and avoid your supervisor.
8. People do go out of their way to help each other work safely.
9. Safety personnel are unavailable when we need help.
10. Around here, employees who have to follow safety and health procedures are seldom asked for input when the procedures are developed or changed.

Pride and Commitment

11. Around here, people take pride in how safely we operate.
12. In this company, people stand up for the safety of their operations when others criticize it unfairly.
13. Around here, people look at the company safety record and take pride in it.
14. In this company, I cannot significantly impact the company's safety record.
15. In this company, people think safety isn't their concern—it's all up to their manager and others.
16. Around here, people see safety as the responsibility of each individual.
17. This company cares about the safety of its employees.

Excellence

18. In this company, we have the highest standards for safety performance.
19. Around here, people are always trying to improve on safety performance, even when they are doing well.
20. People are often satisfied with routine and mediocre considerations for safety.
21. Around here, the way we work now is safe enough.
22. In this company, there is no point in trying harder to be safe; no one else is.

Honesty

23. In this company, people work safely, even when the boss isn't looking.
24. Around here, people wear safety equipment even when they know they aren't being watched.
25. Around here, people are willing to comply with safety measures and regulations.
26. In this company, people try to get around safety requirements whenever they get a chance.

Communications

27. In this company, we hesitate to report minor injuries and incidents.
28. We don't get adequate information about what is going on with safety in the company.
29. Around here, there's lots of confusion about who to contact for safety concerns.
30. Around here, safety statistics are seldom studied and discussed.
31. In our company, safety hazards are seldom discussed openly.
32. Timely feedback is seldom provided when a safety hazard is reported.
33. In this company, you cannot raise a safety concern without fear of retribution.
34. In this company, we have very few safety signs or posters.
35. Around here, employee ideas and opinions on safety are solicited and used.
36. People who raise safety concerns are seen as trouble makers.

Leadership and Supervision

37. It's a tradition; safety matters are given a low priority in meetings.
38. In our company, managers don't show much concern for safety until there is an accident.
39. In this company, the people who make safety decisions don't know what is going on at the workers' level.
40. Around here, work is organized so that you can do the job safely.
41. Around here, managers seldom work with their groups to identify and correct safety concerns or problems.
42. In our company, employees who will implement plans are seldom involved in reviewing their safety implications.
43. Managers/supervisors are often not available to answer health and safety questions.
44. My manager/supervisor discussed safety and health issues in my last employee evaluation.
45. Supervisors are receptive to learning about safety concerns.
46. In this company, people who work safely get no real rewards.
47. Little special recognition is given to safe employees.

Innovation

48. Around here, people are constantly on the lookout for ways of doing things more safely.
49. People tend to hang on to the old ways of doing things without regard to their safety implications.
50. In this company, people are encouraged to express new safety ideas and suggestions.
51. Around here, you get little recognition for new safety ideas.
52. It's a tradition; you don't raise safety ideas that your boss doesn't have first.

Training

53. People mostly give lip service to safety training; they do little to actively support it.
54. In this company, safety training is compromised in favor of more pressing demands.
55. Around here, managers are not very well trained to identify and address safety concerns.
56. In this company, safety training doesn't address subjects of real concern.
57. It's a tradition; safety training is done on a regular basis.
58. People in this company are well prepared for emergencies, and everyone knows just how to respond.
59. I know who to talk to when I see a hazard or have health and safety concerns.

Customer Relations

60. Employees here are always looking for ways to satisfy the customers' needs and requirements.
61. Customers here count on our company to do its work safely.

Procedure Compliance

62. In this company, we have a long way to go in improving our compliance.
63. In this company, people are often uncertain about what the safety procedures are for the work they do.
64. In general, people are well acquainted with the safety procedures for their job.
65. In this company, the safety procedures are relevant to employees' particular circumstances.
66. Around here, there are lots of safety procedures that don't really apply to the particular areas or circumstances in which they are supposed to be tested.
67. There are so many procedures they interfere with doing a job safely.
68. In this company, area requirements for protective clothing and equipment may not reflect the actual hazards.
69. In this company, employees use their heads and raise lots of questions about why things are being done the way they are.
70. In this company, procedures are too detailed, making compliance a mindless activity.
71. It's a tradition; people carefully follow written procedures.

72. In this company, people can be confident they are safe when they are following the rules.
73. Around here, you can't expect praise and recognition for complying with procedures.
74. In this company, following safety procedures is consistently expected.
75. Safety procedures tend to be too vague and general to apply in specific situations.

Safety Effectiveness

76. When it comes down to it, people in this company would rather take a chance with safety than miss a schedule or budget commitment.
77. In this company, people are willing to expend a great deal of effort to get a job done safely.
78. In this company, work is not done that jeopardizes other workers or the public.
79. Employees rarely take the initiative to get safety problems taken care of.
80. around here, people can report a safety problem several times, yet the problems may remain and not get corrected.
81. Our daily routines don't show that safety is an important value.

Facilities

82. In this company, the physical conditions of work locations inhibit safe work.
83. In this company, facilities are designed with safety in mind.
84. Concern and attention is being given to maintaining good safety conditions in our facilities.
85. People tend to keep their facility neat and orderly.
86. Around here, good housekeeping isn't just the janitor's job—people clean up their own areas.
87. In this company, fire and electrical hazards are accepted in some of our facilities.
88. Around here, we really keep on top of the snow and ice problems and prevent them from getting out of hand.

Note: This table was taken from the study done by Ostrom and others (1993:170-172).

Appendix C. Employee Survey

Age: 17-19 20-29 30-39 40-49 50-59 60+

Educational Background (circle one)

High School Some College Associates Degree Bachelor Degree Bachelor +

Years of Experience with Current Employer: <5 5-10 10-20 20-30 30+

Answer all questions in the context of your current supervisory position.

1. The safety training I receive permits me to work free of accidents or injuries.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

2. If I know a coworker is going to do a hazardous job, I am willing to remind him/her of the hazards.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

3. Workers' safety practices are important to management in this company.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

4. All employees are treated equally.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

5. In the long run, the accidents that happen to us are due to chance.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

6. Accident prevention is the responsibility of supervisors and others; there is not much the "little guy" can do about it.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

7. Most accidents are the result of unsafe actions, unsafe conditions or both.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

8. Policies and procedures are implemented similarly for the entire organization.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

9. Supervisors and other top management truly care about my safety.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

10. I feel comfortable praising my coworkers for working safely.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

11. Typically, safety training occurs only after a mishap.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

12. Accidents will always occur, no matter how hard people try to prevent them.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

13. If it wasn't required, safety training would not be well-attended.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

14. I am willing to warn other coworkers about working unsafely.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

15. My immediate supervisor makes us aware of dangerous work practices and conditions.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

16. Supervisors and other managers promote success in the workplace.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

17. Capable people who fail to prevent accidents have not taken proper precautions.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

18. It is difficult to have much control over the things that cause accidents.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

19. Our safety training program is a waste of time.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

20. I am willing to do whatever I can to improve safety, even confronting other coworkers about their unsafe acts.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

21. My supervisor praises employees for safe conduct.

1	2	3	4	5	6
Always	Frequently	Often	Sometimes	Seldom	Never

22. If employees were left to perform on their own, the organization would be more productive.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

23. Safety requirements tend to be so unrelated to the job that following them is useless.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

24. One major reason why we have accidents is because people don't take enough interest in safety.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

25. In this company, safety training is compromised in favor of more pressing demands.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

26. I am willing to observe the work practices of a coworker and record his/her safe and unsafe behaviors.

1	2	3	4	5	6
Always	Frequently	Often	Sometimes	Seldom	Never

27. Job safety meetings are held often enough.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

28. I personally have a say in what the organizational goals are.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

29. Most people don't appreciate the extent to which work injuries are controlled by accidental happenings.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

30. With enough effort, I can prevent work-related injuries.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

31. Management sets objectives that I have no control over.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

32. Proper equipment is always available in my workplace.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

33. I am willing to pick up after another employee to maintain good housekeeping.

1	2	3	4	5	6
Always	Frequently	Often	Sometimes	Seldom	Never

34. When I see a potential safety hazard, I am willing to correct it myself if possible.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

35. It is very likely that I will be injured on the job in the next year.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

36. I am willing to pick up workplace litter I did not cause myself.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

Appendix D. Supervisor Survey

Age: 17-19 20-29 30-39 40-49 50-59 60+

Educational Background (circle one)

High School Some College Associates Degree Bachelor Degree Bachelor +

Years of Supervisory Experience: <5 5-10 10-20 20-30 30+

Answer all questions in the context of your current supervisory position.

1. If I know a subordinate is going to do a hazardous job, I am willing to remind him/her of the hazards.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

2. The safety training I receive permits me to work free of accidents or injuries.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

3. Workers' safety practices are important to me.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

4. I personally have a say in what the organizational goals are.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

5. In the long run, the accidents that happen to us are due to chance.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

6. Typically, safety training occurs only after a mishap.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

7. It is important that I praise my subordinates for working safely.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

8. Top management truly cares about my subordinates safety.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

9. I have no control over the objectives set for my section or area.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

10. Most accidents are the result of unsafe actions, unsafe conditions or both.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

11. Accident prevention is the responsibility of supervisors and others; there is not much the "little guy" can do about it.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

12. If it wasn't required, safety training would not be well-attended.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

13. I am willing to pick up after employees to maintain good housekeeping.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

14. It is my job to praise employees for safe conduct.

1	2	3	4	5	6
Never	Seldom	Sometimes	Often	Frequently	Always

15. If I were left alone, I could make my area or section more productive,

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

16. Capable people who fail to prevent accidents have not taken proper precautions.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

17. Accidents will always occur, no matter how hard people try to prevent them.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

18. Our safety training program is a waste of time.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

19. I am comfortable praising my subordinates for working safely.

1	2	3	4	5	6
Always	Frequently	Often	Sometimes	Seldom	Never

20. Job safety meetings are held often enough.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

21. My area or section is treated differently than the rest of the organization.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

22. Safety requirements tend to be so unrelated to the job that following them is useless.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

23. It is difficult to have much control over the things that cause accidents.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

24. In this company, safety training is compromised in favor of more pressing demands.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

25. One major reason why we have accidents is because people don't take enough interest in safety.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

26. With enough effort, I can prevent work-related injuries.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

27. Most people don't appreciate the extent to which work injuries are controlled by accidental happenings.

1	2	3	4	5	6
Strongly Disagree	Disagree	Disagree Somewhat	Agree Somewhat	Agree	Strongly Agree

28. Proper equipment is available to my subordinates.

1	2	3	4	5	6
Always	Frequently	Often	Sometimes	Seldom	Never

29. I expect one of my subordinates to be injured on the job in the next year.

1	2	3	4	5	6
Strongly Agree	Agree	Agree Somewhat	Disagree Somewhat	Disagree	Strongly Disagree

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Vita

Lt Douglas E. McClain was born 28 December 1963 in Kansas City, Kansas. He graduated from Magnolia High School, New Martinsville, WV in 1982 and enrolled at West Virginia University that fall. He transferred to West Liberty State College in 1983 and graduated in 1986 with a Bachelor of Science in Business Administration. After graduation he worked for 8 years as an assistant football coach at both West Liberty State and West Virginia Institute of Technology. In March 1994, he entered Officer Training School and received his commission and was awarded the honor of Distinguished Graduate on 22 June 1994. After attending Transportation Officer School and being selected as Honor Graduate, he was assigned to the 7th Transportation Squadron, Dyess AFB, Texas. In the Spring of 1994, he became the Chief of Transportation for the 4401st Asset Reconstitution Squadron, responsible for all aspects of transportation related to base closure. Upon matriculation from the Air Force Institute of Technology, Lt McClain will be assigned to the 630th Air Mobility Support Squadron, Yokota ABS, Japan.

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13. ABSTRACT (*Maximum 200 Words*)

It is clear that the Department of Defense and the USAF, in an effort to cut costs, will continue to reduce infrastructure through base closures. This has particular implications to the civilian employee who will likely lose his or her job. The purpose of this study was to review the most recent literature relating to safety and industrial facility closures and develop a theoretical model for predicting accident or mishap rates.

From the literature reviewed, a theoretical model is proposed containing five candidate variables intended to measure; perceived adequacy of employee safety training, perceived safety culture, perceived safety climate, self-reported employee morale, Safety Locus of Control; as well as five candidate indicator variables intended to measure; equipment maintenance levels, company resources allocated for safety, levels of overtime performed, quality or re-works, occurrence of personal site visits by Distinguished Visitors.

Potential survey instrument items are provided along with a proposed implementation plan for the five Air Logistic Centers. Prevention of accidents through proactive policies may lead to additional savings through claims cost avoidance. Model validation and item analysis are left as a follow-on effort to this research.

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